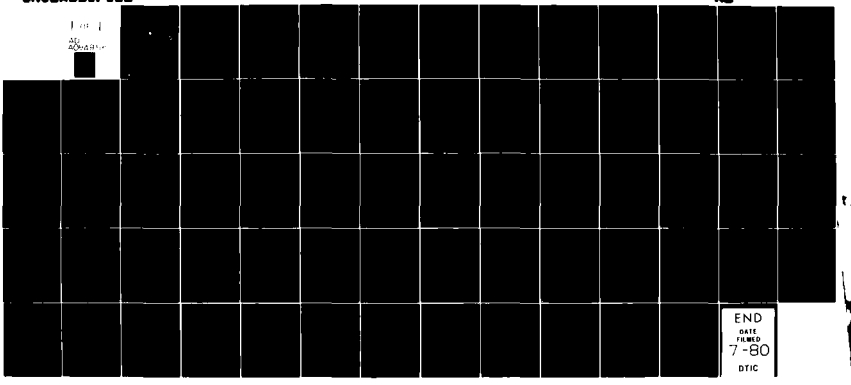
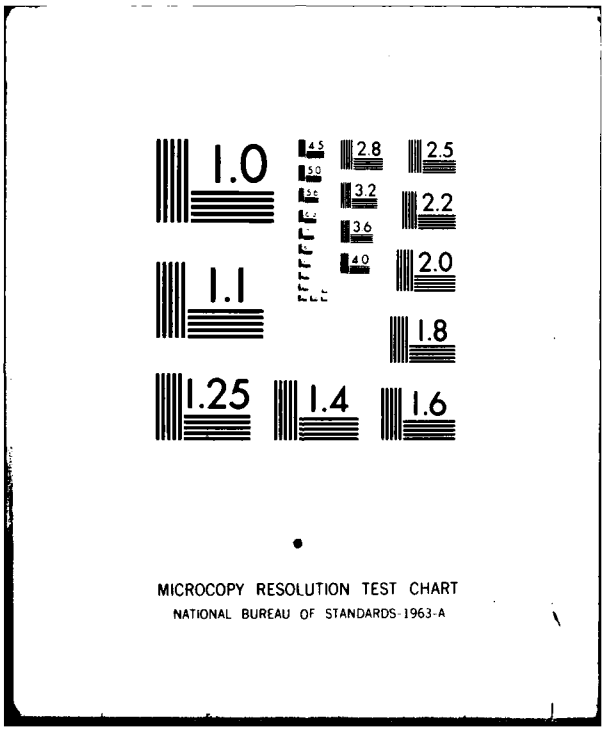
AD-A084 956 NAVAL POSTGRADUATE SCHOOL MONTEREY CA F/G 5/9
RELATIONSHIP OF RADIOMAN CLASS A SCHOOL TRAINING DECISIONS TO I--ETC(U)
MAR 80 R G BELANGER

UNCLASSIFIED NL



END
DATE FILMED
7-80
DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

LEVEL II

NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

Relationship of
Radioman Class A School Training Decisions
to
Instructional Systems Development
Task Selection Criteria

by

Ronald Glafey Belanger

March 1980

Thesis Advisor: James K. Arima

Approved for public release; distribution unlimited

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A084 956 / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Relationship of Radioman Class A School Training Decisions to Instructional Systems Development Task Selection Criteria,	5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; March 1980 / 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Ronald Glafey Belanger	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940	12. REPORT DATE March 1980 / 13. NUMBER OF PAGES 65
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Naval Postgraduate School Monterey, California 93940	15. SECURITY CLASS. (of this report) Unclassified / 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited	
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)	
18. SUPPLEMENTARY NOTES	
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) personnel management, journeyman level, ship personnel, military personnel, radio operators, individualized training, job training, military training	
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This study investigated the extent to which the Instructional Systems Development (ISD) process for task selection is being used to determine tasks that are trained at Radioman Class A School. Data Correlation Sheets containing the criteria ratings by the subject matter experts for all general radioman tasks formed the data base. The data were evaluated using discriminant analysis, correlation analysis, and factor analysis contained in →	

DD FORM 1 JAN 73 1473 (Page 1) EDITION OF 1 NOV 65 IS OBSOLETE S/N 0102-014-6601

UNCLASSIFIED 251450

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

the Statistical Package for the Social Sciences. The results indicated that the number of selection criteria can be greatly reduced and still yield proper classification of the tasks. Although the ISD process is doing an adequate job of task selection for the school, this research discovered that a proper combination of fewer criteria may improve the efficiency and effectiveness of the process.

Approved for public release; distribution unlimited

Relationship of Radioman Class A School Training Decisions to Instructional Systems Development Task Selection Criteria

by

Ronald Glafey Belanger
Lieutenant, United States Navy
B.A., University of Oklahoma, 1974

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN TELECOMMUNICATIONS SYSTEMS MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
March 1980

Author _____

Approved by: _____
Thesis Advisor

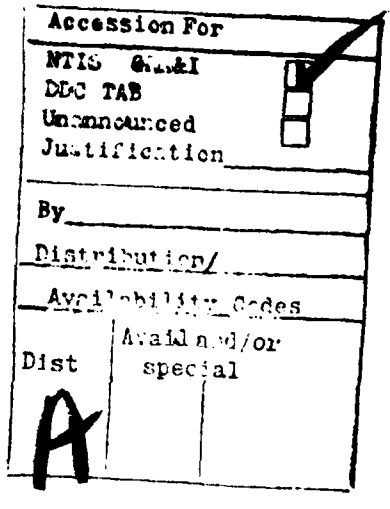
_____
Second Reader

_____
Chairman, Department of Administrative Sciences

_____
Dean of Information and Policy Sciences

ABSTRACT

This study investigated the extent to which the Instructional Systems Development (ISD) process for task selection is being used to determine tasks that are trained at Radioman Class A School. Data Correlation Sheets containing the criteria ratings by the subject matter experts for all general radioman tasks formed the data base. The data were evaluated using discriminant analysis, correlation analysis, and factor analysis contained in the Statistical Package for the Social Sciences. The results indicated that the number of selection criteria can be greatly reduced and still yield proper classification of the tasks. Although the ISD process is doing an adequate job of task selection for the school, this research discovered that a proper combination of fewer criteria may improve the efficiency and effectiveness of the process.



CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

The creation of this thesis would not have been possible without the kind assistance of a number of people. I am very grateful to RMC Hendricks and RMC Straub of the Radioman Class A School staff, who gave generously of their time to ensure that I gained a full understanding of the school's processes and operations. Appreciation is also extended to Ms. Saundra Drummer of IPDD in San Diego for gathering a comprehensive package of ISD and RM A School material for use as the basis of this thesis. Special thanks go to Professor Denise Rousseau for her many helpful suggestions and to Professor James Arima for his devotion of time and energy in the guidance and direction of this research. To my wife, Carol, I owe my deepest gratitude for her patience, never ceasing support and encouragement, and for converting the early handwritten drafts of this thesis into typed form.

INTRODUCTION

Importance of Entry-Level Training for Radiomen

The focus of this thesis was directed specifically toward radioman training due to the unique character and criticality of the rating. Because of the continuous advancements and improvements in the telecommunications industry, the training of the operators must be constantly scrutinized and evaluated to keep abreast with technology.

Over the last decade the Navy has witnessed its telecommunications expand from use of only the high frequency portion of the spectrum for long haul communications to its current use of the ultra and super high frequency ranges for the same type of communications through the employment of satellite communications systems, encryption devices, decryption devices, and other equipments all designed to produce more rapid and efficient communications.

To operate and maintain the complex array of telecommunications equipment in the Navy's inventory, the human factor of the equation must not be ignored. Training of radiomen, especially at the entry-level phase, should prepare the student to meet the challenge with appropriate understanding and the necessary level of skills to accomplish tasks expected of his or her skill level. Poorly or inadequately trained radiomen sent to their respective assignments would only lead to an inefficiency within the overall system. It is imperative, therefore, that radiomen receive

the proper amounts of training prior to reporting for duty and that the tasks selected for that training be appropriate for the job.

Early in a radioman's career, assignments may be expected to naval telecommunications centers or naval communications stations ashore or to any of various ship types at sea. On the average, of the students graduating from Radioman Class A School, 40% are assigned to shore installations while the remaining 60% are assigned to sea duty.[1] Duties ashore are primarily concerned with sending, receiving, and processing message traffic, whereas duties at sea range from the set up and operation of radioteletype circuits with appropriate cryptographic equipment, to publication corrections and message distribution (Radioman 3 & 2, 1978). In times of emergency or increases of threat in the environment, the radioman must be able to act quickly and effectively in establishing and maintaining point-to-point communications.

Doctrine for Selecting Tasks for Training

Some tasks associated with a rating are rarely performed and if neglected would cause little or no job degradation, while the criticality of adequate performance on other tasks makes training for them essential. Budgetary and time constraints, however, impose certain restrictions which make

[1]Indicated during personal communications with RMC Hendricks of Radioman Class A School in December, 1979.

necessary the decision as to which tasks get chosen for training and which do not. Thus, a selection process must be utilized. The purpose of this selection process should be to ensure that the important tasks will receive instruction and to avoid wasting instructional resources on unimportant tasks (CNET, 1978).

Selection of training tasks in the Navy is done by a process called Instructional Systems Development (ISD). This is a systematic set of procedures for completely designing instructional programs. The full process includes five major phases: analysis, design, development, implementation, and control. The selection step falls under the analysis phase and contains specific tools and criteria for making selection decisions. In addition, the ISD process also determines the appropriate instructional setting for those tasks selected for training. Class A School is delegated those tasks appropriate to vestibule training, Class C School is reserved for tasks in which advanced level training is more appropriate, and on-the-job training is designated for those tasks for which no formal schooling is deemed necessary.

Research Objectives

Radioman Class A School has recently come under criticism for alledgedly producing graduates who do not possess the basic knowledge and skills needed to operate standard communications systems or function adequately in the communications environment (COMNAVAIRPAC, 1979). This leads to an important

question: How influential are the task selection criteria for selection of tasks for vestibule training in the case of Radioman Class A School?

To answer the question of task selection effectiveness, specific research objectives were created:

1. To what extent do prescribed ISD procedures for task selection actually determine the tasks that are trained?

2. How do decision-makers actually use the ISD selection criteria for decision making?

3. Can the ISD decision criteria be used more effectively for selecting tasks for training?

ISD PROCEDURES FOR TASK SELECTION

Task Description

For a greater appreciation of task evaluation and selection, the reader should be familiar with the official criteria for the identification of job tasks (CNET, 1976):

Task Definition

A task is the lowest level of behavior in a job that describes the performance of a meaningful function of the job.

Task Characteristics

1. A task statement is a statement of a highly specific action.
2. A task has a definite beginning and end.
3. Tasks are performed in relatively short periods of time.
4. Tasks must be observable.
5. A task must be measurable.
6. Each task is independent of other tasks (performed for its own sake).

Selection Criteria

Prior to the actual task selection process, a job task inventory (JTI) is composed through studies and surveys in the field. For radioman training, the JTI identifies general radioman tasks, that is tasks which do not require any special NECs. Once these tasks are compiled, the lists are submitted to groups of Subject Matter Experts (SME) for rating and evaluation.

The ratings are recorded on Data Correlation Sheets. Each sheet has several columns for the criteria which are rated on a scale from 1 to 5. Generally speaking, the higher the rating (i.e., the closer to 5) the higher the priority for training. The following criteria are utilized as an aid in selecting tasks for training and are listed with their respective codes:

Probable Consequence of Inadequate Performance. This is a measure of the effect a job may have on the mission if it is unsatisfactorily performed.

1. Negligible
2. Rather trivial
3. Fairly serious
4. Very serious
5. Disastrous

Delay Tolerance. This is a measure of how much delay may be tolerated between the time the need for task performance arises and the time actual performance must begin.

1. Extremely high (Performance may be delayed for a considerable period)
2. High
3. Average
4. Low
5. Extremely Low (Task requires immediate performance)

Learning Difficulty. This indicates the effort, time and assistance needed by a student to acquire proficiency in the performance of the task.

1. Extremely low (No training is required)
2. Low
3. Average
4. High
5. Extremely high (Training is essential)

Probability of Deficient Performance. This is the likelihood that the job performer will perform the task unsatisfactorily.

1. Rarely, if ever.
2. Less often than other tasks.
3. About as often as other tasks.
4. More often than other tasks.
5. Very often.

Time Between Job Entry and Task Performance. This is the lapse of time that occurs between the time the person reports for duty in a job and the time he or she actually carries out the particular task.

1. Task not yet performed.
2. Task first performed beyond four years after assignment.
3. Task first performed between two and four years after assignment.
4. Task first performed between one and two years after assignment.

5. Task first performed during first year after assignment.

Decay Rate. This is an estimate of the length of time a student is able to retain knowledge and skills learned.

1. Extremely high (Knowledge is rapidly lost)
2. High
3. Average
4. Low
5. Extremely low (Knowledge is retained for a long period)

Complexity. This is a measure of how complicated the task is to perform.

1. Extremely low (Simple)
2. Low
3. Average
4. High
5. Extremely high (Complex)

Frequency of Performance. This is a measure of the expected rate at which the task is likely to be performed.

1. Never performed.
2. Performed less than once per month.
3. Performed at least once per month but less than twice per week.
4. Performed twice per week.
5. Performed more than twice per week. (Daily)

Subject Matter Expert Evaluation Period

Prior to selection of the tasks included in the current course at Radioman Class A School, Subject Matter Experts from the school evaluated all the tasks of the JTI on the Data Correlation Sheets. The evaluation occurred over a three-month period from August 1976 to 1 November 1976. Once each week the SMEs gathered and, as a group, rated tasks on each of the criteria. Of the total group of 17 SMEs, only five at any time would rate any given task.[2]

After rating the tasks on the criteria, the SMEs were asked to recommend the appropriate training facility: "A" School, "C" School, Fleet Training or Functional School, formal on-the-job-training, or no formal training. The SMEs did not actually select tasks for training, they only recommended the instructional setting (Kennedy, Kalivoda, Dickie, Drummer, and Duember, 1978).

Selection Judgment

The ratings assigned to the task criteria were based upon the SMEs' experience and judgment. Although the SMEs did not actually select the tasks to be trained, using the results of their task criteria ratings they did make recommendations regarding such task selection.

---

[2]As indicated in personal communications with Mr. Richard Lund, the Front End Analysis Project Manager at the time, 22 February 1980.

The selection of tasks for training is a judgment which requires:

--A clear understanding of the duties, tasks, and elements that make up the job.

--Analysis of collected data by individuals who are familiar with the job.

--An understanding of the resources and the responsibility of the command that makes the training choice.

--A clear understanding of when and under what conditions training is appropriate. (CNET, 1978, p. 11).

The Data Correlation Sheet

The Data Correlation Sheets derive their tasks from those listed in the associated JTI. The Data Correlation Sheet itself breaks down into a number of columns for each task listed thereon. See Figure 1.

The first column indicated the task number assigned to the specific task in the JTI. The letter in this alphanumeric group signifies that the task is a member of one of the following groups:

A - Administrative Tasks

B - Shore Tasks

C - Sea Tasks

D - Traffic Handling - Circuit Operations Tasks

E - Automated Systems Tasks

DATA CORRELATION SHEET

RATING RM

TASK NO.	TASK	NOTAP NUMBER	% Performing NOTAP			SME JUDGMENT AREA										REMARKS
			E-2 to E-4	E-5 to E-6	E-7 to E-9	EXISTING SKILL LEVEL	Probable Consequence of Inadequate Performance	Delay Tolerance	Learning Difficulty	Probability of Deficient Performance	Time Between Job Entry and Task Performance	Delay Rate	Complexity	Frequency of Performance	Suggested Skill Level	Percentage of Trainees Currently Serving	
A4-40	Assign personnel to watch quarter and station bill	C22	2	7	38	7	2	2	2	2	2	1	3	3	7		
A4-41	Assign personnel to watch stations	A2	13	46	75	7	2	2	2	2	2	1	3	3	7		
A4-42	Participate in field days, sweepdowns, and similar activities	Z1	81	69	13	2	3	3	1	2	5	1	1	5	2		
A4-43	Participate in working parties	Z3	35	18	25	2	3	3	2	2	5	1	2	5	2		
A4-44	Participate in inspections (zone, personnel, safety)	Z9	36	34	38	2	3	3	2	3	5	1	2	4	2		
A4-45	Participate in mtgs, seminars, conferences	Z10	45	55	50	4	2	2	2	2	3	1	2	4	4		
A4-46	Participate in communications emergency drills (power failure, causualty)	D17	34	38	50	2	4	5	3	4	4	2	3	2	2		
A4-47	Participate in communication exercises/drills	D18	42	44	50	2	4	5	3	4	4	2	3	2	2		
A4-48	Participate in aircraft emergency drills	Q8	1	0	0	5	4	5	3	3	2	2	2	2	5		
A4-49	Participate in general drills	25	25	22	13	2	3	5	3	3	5	1	2	5	2		
A4-50	Conduct inspections (zone, personnel, safety	Z8	2	9	38	6	3	2	2	2	2	1	1	4	6		
A4-51	Conduct meetings, seminars, conferences	Z11	3	5	13	8/9	2	2	2	2	2	1	1	2	8/9		
A4-52	Conduct communications emergency drills (power failure, casualty)	-	-	-	-	6	4	5	3	4	4	2	3	2	7		
A4-53	Conduct communication exercises/drills	-	-	-	-	6	4	5	3	4	4	2	3	2	7		
A4-54	Conduct aircraft emergency drills	-	-	-	-	6	4	5	3	4	4	2	3	2	7		
A4-55	Conduct general drills	-	-	-	-	6	4	5	3	4	4	2	3	2	7		

Figure 1. Example of a Data Correlation Sheet.

The "task" column contains the title of the task. The Navy Occupational Task Analysis Program (NOTAP) number follows and contains no significance for this thesis.

The next three columns are composed of the percentages within rate groups who perform the given task as determined by the NOTAP surveys.

Following these percentage columns is the "Existing Skill Level" column which indicates the minimum rate required to perform the task. The code ranges from 2 to 9 and stands for E-2 to E-9.

The task criteria ratings described earlier constitute the entries for the next seven columns.

The "Suggested Skill Level" consists of the recommended rate as judged by the SMEs. In most cases, the figures in this column were found to be identical to those in the "Existing Skill Levels" column.

The final two columns, "Recommended Instructional Setting" and "Remarks" were left blank on all sheets.

METHOD

Approach

To analyze the task selection process, the actual output of the Radioman Class A School instructional systems development process in the form of finished Data Correlation Sheets was used. The ratings on the selection criteria were analyzed to determine the degree to which they predicted the training decision for each task.

Of the nearly 600 individual tasks evaluated for all radioman skill levels, this study considered 125. Using the Job Task Inventory (JTI) as a reference indicating which tasks were currently being taught in the Class A School and the Data Correlation Sheets as a guide to their designated skill levels the author was able to restrict the field of tasks to be investigated (CO, NETSCPAC, 1979). Among those tasks that were examined were all the tasks specified as E-2 skill-level tasks, those currently taught at the Radioman Class A School as well as those not taught. Additionally, those tasks assigned a higher existing skill level than E-2 and which were also taught at the school were also included in the analysis. Tasks which required a minimum skill level above E-2 and weren't taught at the school were not used, under the assumption that such skills were irrelevant to a school primarily concerned with vestibule training.

The dependent variables then consisted of three groups or categories:

1. Tasks at the E-2 skill level which were not taught.
2. Tasks at the E-2 skill level which were taught.
3. Tasks above the E-2 skill level which were taught.

The independent variables manipulated were the task criteria rated by the SMEs as well as the percentage of E-2s to E-4s in the Radioman rating that perform the task as taken from the associated NOTAP survey. The independent variables used were:

1. Percentage of E-2 to E-4 Performing Task
2. Probable Consequence of Inadequate Performance
3. Delay Tolerance
4. Learning Difficulty
5. Probability of Deficient Performance
6. Time Between Job Entry and Task Performance
7. Decay Rate
8. Complexity
9. Frequency of Performance

Analytic Procedure

Various statistical methods available in the Statistical Package for the Social Sciences (SPSS) were used for analysis. The programs and data were run using batch processing on the IBM 360 series computer located at the Naval Postgraduate School. The source of the tables in the next chapter is the computer output from these programs.

Discriminant analysis was performed to see if the tasks belonging to one of the three dependent variable groups could

be statistically distinguished from those belonging to the others and which variables influenced this discrimination the most. This analysis was also done to determine how well tasks could be classified correctly as to their group memberships.

Correlation analysis was conducted for the purposes of noting significant relationships among the variables.

Factor analysis was done to try to consolidate the independent variables into a smaller list of criteria which form distinct attributes.

All tasks, with their factor scores from the factor analysis, were entered back into a discriminant analysis. The results of this analysis were then compared with the original discriminant analysis.

Description of the Analytic Techniques Used

Discriminant Analysis

The mathematical objective of discriminant analysis is to weight and linearly combine the discriminating variables in some manner so that the groups are forced to be as statistically distinct as possible. Discriminant analysis provides a classification aspect whereby one may insert a case with unknown membership and receive an assignment for that case into a group based upon a derived set of classification functions. It also uses several statistical tests for measuring the success with which the discriminating variables actually discriminate when combined into the

discriminant functions. Variables which contribute the most to differentiation along the respective functions are identified (Klecka, 1975).

Correlation Analysis

It is often desirable to observe and measure the association which occurs between two or more statistical series. The association between series may be established and measured by means of regression analysis. Pearson correlation is one of the variations of regression analysis used to discern variable relationships. It yields the correlation coefficient value of variable pairs as well as their statistical significance (Arkin & Colton, 1960).

Factor Analysis

Factor analysis is employed to combine many variables into smaller groups from which to make statistical inferences or to apply further analytical techniques. Factor analysis may be useful in any of a number of ways. It was applied to this thesis in the following ways:

1. Data Reduction -- Consolidation of many variables into a few, easily handled variables.
2. Data Transformation -- Translation of results into factor scores to be further processed through discriminant analysis.
3. Exploratory Uses -- To uncover unsuspected relationships which may seem startling at first glance, but are actually common sense (Rummel, 1970).

RESULTS

Descriptive Statistics

To present an overview of the individual selection criterion ratings, Table 1 presents the means and standard deviations of each task selection criterion by criterion group and also as a total figure for all the categories combined. The "Percentage of E-2s to E-4s Performing" variable used a scale ranging from 1 to 100, while the rest employed scales from 1 to 5.

Group 1 is comprised of all those tasks requiring a minimum skill level of E-2 for proper performance which were not being taught in the course at Radioman Class A School. Classification of this group and the others was based upon the 1979 Job Task Inventory for general radioman tasks and the Data Correlation Sheets. Group 2 consists of the remaining E-2 tasks, all of which were being taught in the school. Group 3 contains all the other tasks that were being taught and which were determined to have a minimum existing skill level higher than E-2.

Prediction and Policy Capturing

Discriminant analysis was performed using the Wilks' stepwise method. The use of a stepwise procedure produces an optimal set of variables being selected. It is an efficient means of approximately locating the best set of discriminating variables. The Wilks' lambda is a measure of group discrimination (Nie, Hull, Jenkins, Steinbrenner, & Brent, 1975).

Table 1

Means and Standard Deviations of Criterion Groups

on the Task Selection Criteria

Task Criterion	Group 1	Group 2	Group 3	Total
Percentage of E-2 to E-4 Performing	36.93 28.77	38.09 29.54	40.26 36.45	38.30 31.15
Probable Consequence of Inadequate Performance	2.56 1.01	2.26 1.01	3.17 1.22	2.62 1.13
Delay Tolerance	2.88 .96	2.96 1.14	2.77 .91	2.88 1.01
Learning Difficulty	2.35 .87	2.49 .80	2.63 .91	2.48 .86
Probability of Deficient Performance	2.63 .82	2.62 .99	2.60 .85	2.62 .89
Time Between Job Entry and Task Performance	4.93 .26	4.96 .20	3.94 1.00	4.66 .72
Decay Rate	1.33 .61	1.43 .80	1.40 .50	1.38 .66
Complexity	1.51 .86	1.66 .94	2.00 .97	1.70 .93
Frequency of Performance	4.42 .85	4.91 .28	4.66 .48	4.67 .62

Note 1: In each pair of figures the mean is on top and the standard deviation is below.

Note 2: The groups are coded as follows:
Group 1 -- Tasks at the E-2 skill level which were not taught.
Group 2 -- Tasks at the E-2 skill level which were taught.
Group 3 -- Tasks above the E-2 skill level which were taught.

Two functions were derived from the discriminant analysis. Table 2a displays the standardized discriminant function coefficients. Ignoring the sign, each coefficient indicates the relative contribution of its associated variable to the particular function since they are measured on the same scales. The sign just signifies whether the variable makes a positive or negative contribution. The coefficients capture the policy used by the ISD personnel in weighting the task selection criterion variables.

The next table, Table 2b, provides additional information for evaluating the effectiveness of the two derived functions. The eigenvalue is a measure of the relative importance of the function. The sum of the eigenvalues is a measure of the total variance existing in the discriminating variables. The percentage of variance yields an easy reference to the relative importance of the associated function. The canonical correlation is another measure of the function's ability to discriminate among the groups. Wilks lambda is an inverse measure of the discriminating power in the original variables which has not yet been removed by the discriminant functions -- the larger lambda is the less information remains. The significance of the chi-square values indicates that the functions predict the dependent variable considerably better than chance (Nie, et al., 1975).

Classification of the cases applying the discriminant functions is depicted in Table 2c. This table shows the

Table 2

Discriminant Analysis of the Task Selection Criteria

a. Standardized Canonical Discriminant Function Coefficients

Independent Variable	Function 1	Function 2
Probable Consequence of Inadequate.Performance	.301	-.337
Delay Tolerance	-.257	-.010
Probability of Deficient Performance	-.316	-.058
Time Between Job Entry and Task Performance	-.891	-.014
Complexity	.312	.442
Frequency of Performance	.248	.949

b. Statistics Related to the Discriminant Functions

Statistic	Function 1	Function 2
Eigenvalue	.812	.173
Percent of Variance	82.45	17.55
Cumulative Percent	82.45	100.00
Canonical Correlation	.67	.38

	After Function 0	After Function 1
Wilks' Lambda	.47	.85
Chi-Square	90.11	19.06
Degrees of Freedom	12	5
Significance	.000	.002

c. Discriminant Classification of Tasks Versus Actual Task Group Membership

Actual Group	# of Cases	Predicted Group Membership		
		Group 1	Group 2	Group 3
Group 1	43	19 44.2%	24 55.8%	0 0.0%
Group 2	47	11 23.4%	35 74.5%	1 2.1%
Group 3	35	2 5.7%	8 22.9%	25 71.4%

Note 1. For a breakdown of Groups 1, 2, & 3, see Table 1.

Note 2. Percent of "grouped" cases correctly classified: 63.2%.

number of cases (tasks) which belong to each group and the number and the percentage of cases correctly and incorrectly placed. The overall percentage of correct placements was 63.2, whereas the expected (random) placement was 33.3 percent. Thus, the calculated placement is 200 percent better than chance.

Factor Analysis and Factor Scoring of Task Selection Criteria

Factor analysis was used to determine what underlying factors or principles were used in determining which tasks would be taught. The purpose of the analysis was to develop a set of fewer selection criteria that, being more distinct (less overlap), might prove to be more effective and/or more efficient in the classification of job tasks for training.

Table 3 presents the Pearson correlation matrix showing the first-order relationship among the variables that form the basis for the factor analysis. It is conventional to regard a probability of 0.05 as the critical level of significance (Tippett, 1952). The significance was calculated for each criterion pair on the basis of all 125 cases except for those pairs involving the "Percentage of E-2s to E-4s Performing" due to missing values for that variable in 20 of the cases.

The method of principal factoring (without interation and with varimax rotation) was used to extract the factors. Table 4a presents the weights and variance accounted for by the nine factors calculated. Clearly the first three

Table 3

Correlation Matrix of the Independent Variables

	E2E4	INADPERF	DELAYTOL	LEARNDIF	DEFPERF	TIME	DECAYRT	CMPLXTY	FREQ
E2E4	-	139	410	-005	-003	138	-050	-051	061
INADPERF	139	-	221	251	327	-350	016	228	-101
DELAYTOL	410	221	-	373	182	-034	167	116	142
LEARNDIF	-005	251	373	-	403	-155	586	632	-035
DEFPERF	-003	327	182	403	-	-078	532	514	-070
TIME	138	-350	-034	-155	-078	-	-100	-222	131
DECAYRT	-050	016	167	586	532	-100	-	739	-141
CMPLXTY	-051	228	116	632	514	-222	739	-	-183
FREQ	061	-101	142	-035	-070	131	-144	-183	-

Note 1. **E2E4** -- Percentage of E-2 to E-4 Performing
INADPERF -- Probable Consequence of Inadequate Performance
DELAYTOL -- Delay Tolerance
LEARNDIF -- Learning Difficulty
DEFPERF -- Probability of Deficient Performance
TIME -- Time Between Job Entry and Task Performance
DECAYRT -- Decay Rate
CMPLXTY -- Complexity
FREQ -- Frequency of Performance

Note 2. N = 105 for the E2E4 variable pairs; N = 125 for all others.

Note 3. For N=105, $r \geq .19$ ($p \leq .05$), $r \geq .25$ ($p \leq .01$).
For N=125, $r \geq .17$ ($p \leq .05$), $r \geq .22$ ($p \leq .01$).

Note 4. Figures in thousandths. Decimal point is eliminated for convenience and clarity.

Table 4

Factor Analysis

a. Factor Weights

Factor	Eigenvalue	% of variance	Cumulative %
1	3.00	33.4	33.4
2	1.53	17.0	50.4
3	1.26	14.0	64.4
4	.93	10.3	74.7
5	.74	8.3	83.0
6	.55	6.2	89.2
7	.48	5.3	94.5
8	.28	3.1	97.6
9	.21	2.4	100.0

b. Varimax Rotated Factor Matrix

Independent variables[a]	Difficulty (Factor 1)	Immediacy (Factor 2)	Consequences (Factor 3)
E2E4	-.069	.778	-.002
INADPERF	.135	.289	.794
DELAYTOL	.262	.793	.094
LEARNDIF	.786	.186	.132
DEFPERF	.696	.081	.171
TIME	-.079	.164	-.783
DECAYRT	.900	-.083	-.073
CMPLXTY	.869	-.097	.172
FREQ	-.129	.389	-.353

[a]For full variable names see Table 3, note 1.

factors possess the most influence, comprising nearly two-thirds of the total variance. The program retained and printed only components with eigenvalues greater than or equal to 1.0, hence, only the first three factors were considered by the program for the remainder of its analysis (Kim, 1975).

Table 4b portrays the coefficients of each criterion as they lie in each of the three factors. For Factor 1, the criteria of decay rate, complexity, learning difficulty, and probability of deficient performance carried the most weight and, in combination, seemed to indicate a difficulty factor. Hence, Factor 1 was entitled "Difficulty." Factor 2 is dominated by delay tolerance and the percentage of E-2s to E-4s performing the task. This seemed to indicate a feeling of immediacy. Thus, "Immediacy" was the name given to that factor. Probable consequence of inadequate performance and time between job entry and task performance were the strongest coefficients in Factor 3. "Consequences" was the word deemed most descriptive of Factor 3. Varimax rotation has the effect of clustering variables. The overall outcome is a reduction in the number of inputs to be analyzed further.

The cases were individually factor scored using the three factors. Then, the factors were injected into a discriminant analysis using the factor scores for each task.

Table 5a shows that the immediacy factor and the consequences factor were the most discriminating of the three. Function coefficients were assigned accordingly.

Table 5b indicates that Function 1 is overwhelmingly superior in discrimination to Function 2 through the extreme difference between eigenvalues. Note that the percentage of variance of the first function is nearly one hundred percent. There is a correspondingly large difference between the canonical correlations. Notice also that there is an extremely high level of significance for the first function, but the second function is not significant.

Table 5c displays correctly and incorrectly predicted memberships of groups based on discrimination due to factor analysis. Note that the overall percent of "grouped" cases classified correctly is 1.2% less than that of the task criteria discrimination shown in Table 2c. However, from the standpoint of efficiency, the classification is being accomplished with essentially one function that has only two component variables (Factors 2 and 3).

Figures 2 and 3 graphically depict the discrimination based on task criteria and factor scores for their respective functions. Notice how Function 1 in Figure 2 clearly discriminates the tasks with existing skill levels higher than E-2 from all tasks on the E-2 level. Function 2 of the same figure clearly segregates both groups of E-2 skill level tasks from each other. In Figure 3, one may

Table 5

Discriminant Analysis of the Factor Analysis Results

a. Standardized Canonical Discriminant Function Coefficients of the Factor Scored Tasks

Factor	Function 1	Function 2
Immediacy (Factor 2)	-.391	.929
Consequences (Factor 3)	.971	.270

b. Statistics Related to the Discriminant Functions of the Factor Scored Tasks

Statistic	Function 1	Function 2
Eigenvalue	.532	.001
Percent of Variance	99.82	.18
Cumulative Percent	99.82	100.00
Canonical Correlation	.59	.03
	After Function 0	After Function 1
Wilks Lambda	.65	.99
Chi-Squared	51.99	.12
Degrees of Freedom	4	1
Significance	.000	.730

c. Discriminant Classification of Factor Scored Tasks Versus Actual Task Group Membership

Actual Group	# of Cases	Predicted Group Membership		
		Group 1	Group 2	Group 3
Group 1	43	20 46.5%	16 37.2%	7 16.3%
Group 2	47	14 29.8%	32 68.1%	1 2.1%
Group 3	35	2 5.7%	8 22.9%	25 71.4%

Note 1. For Breakdown of Groups 1, 2, & 3, see Table 1.

Note 2. Percent of "grouped" cases correctly classified: 61.6%.

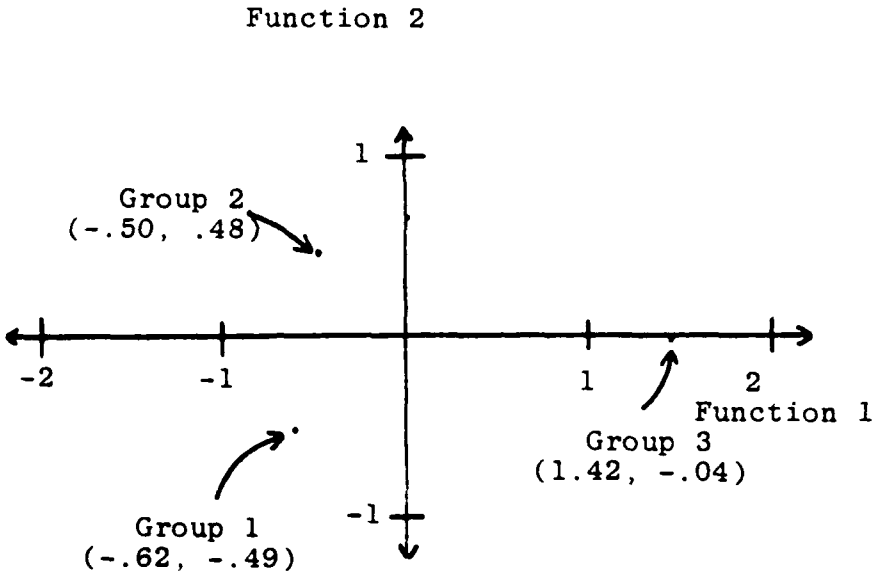


Fig re 2. Scatterplot of canonical discriminant functions of tasks evaluated at group means.

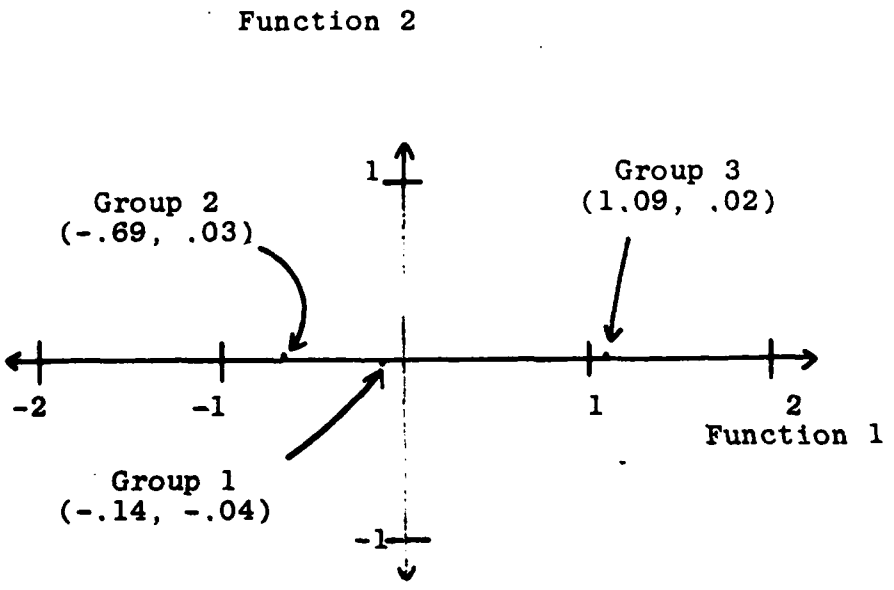


Figure 3. Scatterplot of canonical discriminant functions of factor scored tasks evaluated at group means.

readily discern a negligible amount of effect among the groups by Function 2, while Function 1 exhibits a fair degree of separation among the groups.

DISCUSSION

Overview

It appears as though the ISD process is successful in the selection of important tasks for training at Radioman Class A School. The criteria of probable consequence of inadequate performance, delay tolerance, time between job entry and task performance, complexity, and frequency of performance seem to influence the selection decisions more strongly than the others. However, some criteria used in the selection process detract from the potential efficiency of the process. Their contribution is negligible in most instances. There are ways to increase efficiency through better utilization of the more discriminating criteria.

The results suggest that there exists a clear discrimination between all E-2 tasks and those tasks of a higher skill level. However, an unclear picture remains of the discrimination between the E-2 skill level tasks which are selected for Radioman Class A School training and those that are not. The decision for not selecting a task for training is apparently based upon other criteria such as facilities available, institutional resources available -- both budgetary and personnel, etc.

The analyses raised doubt about whether certain tasks were rated higher following a conscious decision that they needed to be trained or if the selection of the tasks occurred because certain tasks had higher ratings from an objective

rating process. One is unable to ascertain the truth from static data.

Integration of Analytical Findings

Examination of the group means of the criteria reveals that in the majority of instances Group 3 tasks (the higher skilled, taught tasks) are easily distinguishable from the tasks in the E-2 skill level groups by a significant degree. This is readily apparent in the criteria of probable consequence of inadequate performance, delay tolerance, learning difficulty, time between job entry and task performance, and complexity. By contrast, only a few criteria separate Group 2 tasks from the rest, and fewer still separate Group 1 tasks.

Insight may be gained from contrasting pairs of task groups using the criteria means. Probable consequences of inadequate performance exhibits a large difference between Group 2 and Group 3 skills. The same holds for delay tolerance and time between job entry and task performance, although for the latter, the more important result is that Group 3 is discriminated from the combination of Groups 1 and 2 which are nearly equal in value. Learning difficulty displays its greatest separation on Group 3 from Group 1. Decay rate is unique in that it is the only criterion which seems to pull Group 1 out from the others with its low mean. This makes sense because it is better to formally train those tasks which are more easily retained for later use than train the

tasks which will only require retraining at the job site due to knowledge loss. Decay rate and frequency are the only real criteria which markedly contrast Group 1 with Group 2. Unfortunately, this decay rate carries little importance in either of the discriminant analyses performed. Frequency also differentiates Groups 1 and 2. Also, complexity shows a consistent difference for each task group. The probability of deficient performance criterion is too evenly matched across the board to have any important effect in the outcome of the selection process.

For finer analysis of the differences between the groups, discriminant and factor analysis were performed. The discriminant analysis of the task criteria greatly discriminates Group 3 from the others. The high positive weight assigned to probable consequence of inadequate performance in the first function, when multiplied to the group means, boosts the Group 3 value considerably higher than the others. Similarly, the weight of complexity raises the value of Group 3. The criterion of time between job entry and task performance contains a large, negative weight which contributes to a negative value added to the overall score for Group 3, but to a much lesser extent than the negativity which results for both Groups 1 and 2. The second function favors discrimination of Group 2 in that the negative weight assigned to the probable consequence of inadequate performance criterion and the high, positive value associated with frequency of

performance contribute significantly to a higher overall value for the Group 2 scores. This second function is considerably less important than the first function. Thus, overall, this discriminant analysis application is best suited for the classification of Group 3 tasks.

Checking the results of the factor analysis, one sees that the discrimination of groups is pretty much the same, with Group 3 being delineated the best. The Difficulty factor is composed, in part, of learning difficulty, decay rate, and complexity, all of which have high positive weightings which places the value of the Group 3 factor scores well above the other two. These three criteria are the most important in the Difficulty factor. In combination with each other, it would seem that these criteria should be excellent in discriminant analysis. The Immediacy factor favors the discrimination of Group 2 among the others. The high positive weighting of delay tolerance along with the moderately high positive weighting of frequency of performance, boosts the resultant value of Group 2's factor scores higher than those of the other groups. Yet, this factor, too, is relatively insignificant in the discrimination analysis that was performed. In the Consequences factor, the high positive weight for probable consequence of inadequate performance together with the high negative weight for time between job entry and task performance plays an important part in yielding a high value to the Group 3 factor scores. The moderately high

negative weight given to the frequency of performance criterion enables the Group 1 factor scores to be somewhat higher than Group 2 equations, but not as high as those for Group 3. A quick glance at the Function 1 axis in Figure 3 illustrates the point. The Consequences factor is the single most important discriminating factor according to the discriminant analysis.

The discriminant analysis of the factor scores assigns a high positive weight to the Consequences factor and a moderately high negative weight to the Immediacy factor. This has the effect of maintaining the high amount of Group 3 discrimination in the Consequences factor while something interesting happens within the Immediacy factor. Heretofore, the Immediacy factor was a good discriminator of the Group 2 tasks. With a moderately high negative weight multiplied to the Immediacy factor scores, the dominant criteria of delay tolerance and frequency of performance switch from yielding a positive-type influence to yielding a negative-type influence. In reviewing the means, one sees that a negative weight for the delay tolerance criterion yields a result with Group 3 having the higher overall value, and a negative value to frequency of performance gives a higher value to the Group 1 tasks. Thus, the effect of Function 1 in the discrimination analysis of the factor scores is to favorably increase the discrimination of Group 3 through the combination of the consequences and immediacy factors,

as well as to slightly enhance the discrimination of Group 1 tasks. Again, Figure 3 bears this out in placement of group centroids along the x-axis (Function 1). Group 3 is given a high positive value, while Group 1, though slightly negative, is still higher than Group 2 scores. In the same analysis, Function 2 credits both factors (Immediacy and Consequences) with positive weights, the emphasis being on the Immediacy factor. But, this function is of little significance whatsoever in the discrimination abilities of either function.

Alternative Measures

The selection of tasks for training at Radioman Class A School involved review of several different criteria which were carefully rated. However, it appears as though selection may be done just as well from the use of only a few of the criteria based on the analyses performed for this thesis. The factor-scored discriminant analysis uses one function, involving primarily the Consequences factor, to effect a classification with an overall accuracy of 61.6%. The percentage of correct classification of both groups of tasks which are taught is even higher than the overall classification accuracy. Two selection criteria are dominant in the consequences factor; namely, probable consequence of inadequate performance and time between job entry and task performance. Of secondary importance is frequency of performance. In a recent conversation with the

author, Mr. Richard Lund (1980) of Instructional Program Development Department (IPDD), San Diego, stated that although IPDD did not perform a statistical analysis of the criteria for the selection process, the most influential criteria for task selection were probable consequences of inadequate performance, the time criterion, frequency, and decay rate. It is interesting, indeed striking, that the first three criteria mentioned are greatly influential in the Consequences factor. It seems that use of the Consequences factor would increase the efficiency of the criteria rating by reducing the number of independent variables. Prediction can be made just as well with fewer criteria as it is with the full set of criteria. Thus, a small number of criteria has the ability to do all the work of several.

Another approach which merits investigation is the idea of scaling the criteria differently. One possibility is to create a weighted checklist of statements reflecting the full range of attitudes toward each criterion. Each statement would describe one attitude toward the particular criterion. A panel of judges would classify the statements in categories ranging from those they consider to be extremely favorable to those they consider to be extremely detrimental (McCormick & Tiffin, 1974). This classification could be accomplished using the paired comparison technique in which each statement is compared to each other until each is in the most appropriate location in the spectrum. Weights would then be

assigned relative to the final positions of these statements. Checklists of each criterion for each task would then be distributed to the SMEs. Each SME could indicate which statements most accurately depict the criterion for a given task by placing a check mark next to the appropriate statement. The weights of the statements would be unknown to the SMEs. Upon receipt of the completed checklists from each SME, the selection board would tally the weighted checks and determine the overall rating of each task for a training decision. This type of Thurstone scale has been widely used in many psychological tests and for applications relating to discrimination of judgment (Bock & Jones, 1968). To carry this technique one step further, the SMEs, instead of simply marking the appropriate statements, could rank the statements using the paired comparison technique. These rankings, in conjunction with the previously determined weights could further refine the overall ratings of the tasks for the training decision.

Limitations

This analysis focused on a specific application of the ISD process. For a broader generalization with respect to the ISD process of task selection, this analysis should be cross-validated with other schools, e.g., other Class A Schools and advanced Radioman schools. One problem that may occur is that different sets of SMEs may alter the reliability of the results resulting in shrinkage of the predictions.

This analysis concentrated purely on task selection. Use of the JTI and application of the ISD process appears to be fairly good in determining which tasks get trained, but this does not mean that the selection is optimum for the requirements of the Navy. Supervisors and managers in the operational environment perceive training in relation to the end product.

In the task-selection process consideration must be made of how the graduate is able to function in his assignment after graduation. The selection process, analyzed by this thesis, utilized the results of a NOTAP survey in determining the percentages of apprentices performing various tasks. Further follow-up and surveys of initial assignments should be conducted. These surveys should be performed at the sites representative of and in proportion to the types of units to which the graduate is sent. The unique needs of the fleet should be noted in the survey for use as feedback into the ISD task selection process.

Under "ideal" conditions, 40% of Radioman Class A School graduates report to shore stations while the remaining 60% report for sea duty. In a compilation of sea duty assignments, by RM1 Randall of Radioman Class A School, for the period of July 1979 through December 1979, the following list was constructed:

Ship Type	Percentage Assigned
Small Combatants	30.96
Amphibious Ships	22.63
Aircraft Carriers	16.54
Service/Auxiliaries	15.52
Large Combatants	8.52
Submarines	5.11
Mine Warfare	.73

This breakdown in assignments could be used for determining which tasks deserve increased attention (i.e., which tasks are more applicable to a higher percentage of the assignments) as well as for future survey applications.

CONCLUSIONS AND RECOMMENDATIONS

The results determined by the analytical methods of this thesis were based on an exceptionally good data base. The Data Correlation Sheets used were the same ones used by the actual task selection board for the Radioman Class A School course. The ratings assigned to each criterion for every task were done so by subject matter experts intimately familiar with all aspects of the tasks. These subject matter experts were actual Navy radiomen representing a broad base of experience.

Based on the research conducted it is concluded that:

1. Prior to this study, it was unclear whether criteria ratings are being used in a systematic way. It was not clear whether the SMEs were able to purposely rate certain tasks higher to increase the probability of selection for training, or whether the actual tasks selected for training were the result of having a higher rating from an objective process. This thesis has demonstrated that criteria ratings may be used systematically.

2. It appears that there are more efficient/effective ways of evaluating tasks than are currently being used. One possibility suggested is the development and application of a Thurstone scale to criteria rating. This type of scale yields a better insight as to the exact perception the SME has of the tasks than the current scales reveal. Should this scale be used, more efficiency may be reaped by limiting

the criteria to those discovered in the results of this research which carry the most influence.

3. The criteria used, in and of themselves, do not reveal a substantial discrimination of the E-2 skill level tasks which are trained from the E-2 skill level tasks which are not trained. There are apparently other factors outside the criteria judged which play a part in making this determination.

4. Results of this thesis are not necessarily generalizable to other types of schools, be they Class A schools or other Radioman-related schools. The utilization of the criteria ratings in the same fashion may not be appropriate for other schools, nor is it known whether the criteria rating scales should be the same for all.

5. There may be simpler ways of combining criteria to analyze tasks. For the specific case of task selection for Radioman Class A School, the several individual criteria can be consolidated into one factor which works about as well in classification of tasks which should be trained. The factor concerned is the Consequences factor which is dominated by the criteria of probable consequence of inadequate performance and time between job entry and task performance, with frequency of performance acting as a secondary source of influence. With its adequate prediction capability, the consequence factor may be used in task selection, thus saving a great deal of time and resources.

Based on these conclusions, it is recommended that:

1. Similar procedures as employed in this thesis should be used to evaluate task selection for the "classic" A school course. The results of such analyses may prove quite beneficial in terms of reducing overall ISD costs.

2. Development of a different criterion scaling procedure that would be simpler and more effective should be considered. The Navy might be better off in its training selection decisions if a Thurstone scale were used for measuring the tasks in lieu of the current rating process.

APPENDIX A

Criteria Ratings of Tasks Analyzed

from the Data Correlation Sheets

Task	Group*	Criteria*								
		1	2	3	4	5	6	7	8	9
Distribute instructions	1	14	2	2	2	2	5	1	1	4
Distribute notices	1	14	2	2	2	2	5	1	1	4
Distribute directives	1	14	2	2	2	2	5	1	1	4
Participate in field days, sweepdowns, and similar activities	1	81	3	3	1	2	5	1	1	5
Participate in working parties	1	35	3	3	2	2	5	1	2	5
Participate in inspections (zone, personnel, safety)	1	36	3	3	2	3	5	1	2	4
Participate in communications emergency drills (power failure, casualty)	1	34	4	5	3	4	4	2	3	2
Participate in communication exercises/drills	1	42	4	5	3	4	4	2	3	2
Participate in general drills	1	25	3	5	3	3	5	1	2	5
Update broadcast files	1	23	3	3	2	2	5	1	1	5
Update general message files	1	21	2	2	2	3	5	2	1	5
Update world-wide task organization guide	1	16	3	3	2	3	5	2	1	5
Update communications instruction file	1	27	2	2	2	3	5	1	1	4

*A key for the group entries and the criteria is provided at the end of this appendix.

Task	Group	Criteria								
		1	2	3	4	5	6	7	8	9
Update communications notices file	1	24	2	2	2	3	5	1	1	4
Update communication directives file	1	24	2	2	2	3	5	1	1	4
Update crypto center files	1	24	3	3	2	3	5	1	1	5
Update communication center message files	1	11	2	3	2	3	5	1	1	5
Update fax files	1	24	3	3	2	3	5	1	1	5
Update message tape file	1	24	2	2	2	2	5	1	1	5
Make log entries in general message log	2	50	2	2	2	2	5	1	1	5
Make log entries in the broadcast checkoff log	2	50	2	4	2	2	5	1	1	5
Make log entries in the Morse telegraphy (CW) log	1	50	4	4	3	3	5	2	2	4
Make entries in the visual log	1	50	3	3	3	2	4	1	1	3
Make entries in the radiotelephone log	1	50	4	4	3	3	5	2	3	5
Make entries in the order-wire teletypewriter log	1	50	4	4	3	3	5	1	1	5
Make entries in the TTY ship/shore log	2	54	4	4	3	3	5	1	1	5
Receive secret material	3	28	4	3	2	3	4	1	1	5
Control secret material	3	28	4	3	2	3	4	1	1	5
Mark/remark secret material	3	28	4	3	2	3	4	1	1	5
Receive confidential material	3	28	4	3	2	3	4	1	1	5
Control confidential material	3	28	4	3	2	3	4	1	1	5

Task	Group	Criteria								
		1	2	3	4	5	6	7	8	9
Mark/remark confidential material	3	28	4	2	2	2	4	1	1	5
Control classified working papers (rough drafts, etc.)	3	28	4	2	2	2	4	1	1	5
Control classified msc. materials (ribbons, etc.)	3	28	4	3	2	3	4	1	2	4
Identify & correct inadequate safety precautions	3	--	5	5	3	3	4	1	2	5
Cut tapes on the UGC-6 teletype	2	56	2	4	3	4	5	2	3	5
Transmit msgs on the UGC-6 teletype	2	56	3	4	2	2	5	1	1	5
Receive msgs on the UGC-6 teletype	2	56	3	4	2	2	5	2	1	5
Perform operator's maintenance on the UGC-6 teletype	1	56	3	3	2	2	5	1	1	5
Patch with the SB-988/SRT transmitter transfer switchboard	2	06	2	2	2	2	4	1	1	5
Perform preventive maintenance on the SB-988/SRT	1	06	1	1	1	1	5	1	1	3
Receive msg traffic on the AN/FGC-100 TTY terminal equipment	2	04	3	4	2	3	5	2	1	5
Perform operator's maintenance on the AN/FGC-100	1	04	3	3	2	3	5	1	1	5
Pass (send) message traffic on the TT-333	2	04	2	4	3	2	5	1	1	5
Perform operator's maintenance on the TT-333	1	04	2	2	2	2	5	1	1	5
Perform operator's maintenance on the TSEC/KW 26	1	08	4	3	2	3	5	1	2	5
Send (transmit) msg on the TT-333/UG (dist. trans set)	3	04	2	3	2	2	5	1	1	5

Task	Group	Criteria								
		1	2	3	4	5	6	7	8	9
Monitor the AN/FGC-79A (FLT BCST (R)) FLT SATCOM	3	05	2	4	1	1	5	1	1	5
Receive msg on the AN/FGC-79 TTY (FLT center termination)	3	05	2	4	3	3	5	1	1	5
Receive msg and tape on the TT-331 A/UG reperforator	3	03	1	3	1	1	5	1	1	5
Set up the November System (multi-channel receive)	3	17	4	3	4	3	4	2	4	4
Secure the November System (multi-channel receive)	3	--	4	2	4	3	4	2	3	4
Set up the Charlie System (UHF covered duplex)	3	17	4	2	4	3	4	2	4	4
Secure the Charlie System (UHF covered duplex)	3	--	4	2	3	3	4	2	3	4
Set up Romeo System (covered voice)	3	17	4	2	3	4	4	2	3	4
Secure Romeo System (covered voice)	3	--	4	2	3	3	4	2	3	4
Set up Uniform System (uncovered voice)	3	17	3	2	3	3	5	2	3	4
Secure Uniform System (uncovered voice)	3	--	2	2	2	3	5	2	3	4
Set up Golf System (HF covered duplex)	3	17	4	2	4	3	4	2	3	4
Secure Golf System (HF covered duplex)	3	--	4	2	3	3	4	2	3	4
Select channel on the AN/SRA-12 (elect filter assembly)	2	14	2	2	3	3	5	1	1	5
Connect/disconnect the MF-HF antenna (AS-25430) to the AN/SRA-12	1	34	2	2	2	2	5	1	1	5

Task	Group	Criteria								
		1	2	3	4	5	6	7	8	9
Connect/disconnect the MF-HF receiver (R1051) to the AN/SRA-12	2	33	2	2	2	2	5	1	1	5
Patch/unpatch the SB 973 receiver transfer switchboard	2	15	1	2	2	4	5	2	2	5
Patch/unpatch the SB-1203A/UG communication patching panel	2	18	3	2	2	3	5	1	2	5
Perform preventive maintenance on the SB-1203A/UG	1	18	3	2	2	3	5	1	1	3
Patch/unpatch the SB-1210A/UGO communication patching panel	2	20	3	2	2	3	5	1	2	5
Perform preventive maintenance on the SB-1210A/UGO	1	20	3	2	2	3	5	1	1	3
Energize the PP-3495/UG power supply	1	--	1	2	1	1	5	1	1	4
Deenergize the PP-3495/UG power supply	1	--	1	2	1	1	5	1	1	4
Patch/unpatch the SB-988/SRT transmitter transfer switchboard	2	06	1	2	2	3	5	1	2	5
Patch/unpatch the SB-863 transmitter/transfer switchboard	2	14	1	2	2	3	5	1	2	5
Adjust the AN/URA-17 (comparator-converter group)	2	24	2	2	2	3	5	2	2	5
Tune the AN/SRA-13 (coupler group antenna)	1	04	4	3	4	4	5	2	3	5
Energize the AN/UCC-1 telegraph terminal	2	13	1	1	2	1	5	1	1	4
Deenergize the AN/UCC-1 telegraph terminal	2	13	1	1	2	1	5	1	1	4

Task	Group	Criteria								
		1	2	3	4	5	6	7	8	9
Start the CV-2460/SGC telegraph-telephone signal converter	2	00	1	1	2	1	5	1	1	4
Set up the CV-2460/SGC telegraph-telephone signal converter	1	00	2	2	3	3	5	2	3	5
Receive messages on the AN/UGC-25 teletype	2	25	3	2	2	2	5	1	1	5
Operate the AN/SRA 33 (antenna coupler group)	2	04	2	2	3	3	5	2	2	5
Adjust volume on the AM-3729/SR (speaker amplifier)	2	02	1	2	2	1	5	1	1	5
Patch/unpatch the C-7594 (remote switching control)	3	00	2	2	2	2	2	1	2	5
Set up the AN/URT-23(V) radio transmitter set	2	12	3	2	3	3	5	2	3	5
Tune the AN/URT-23(V) radio transmitter set	2	12	3	2	3	2	5	2	3	5
Check and adjust the TSEC/KWR-37 (crypto unit)	3	26	4	2	3	4	4	2	3	5
Perform start sequence on the TSEC/KWR-37	3	26	4	2	3	4	4	2	3	5
Establish cipher communications on the TSEC/KW-7 (crypto unit)	2	46	4	2	3	3	5	2	3	5
Record message transmission in the outgoing circuit log	2	50	2	4	2	2	5	1	1	5
Record time of delivery on the transmitted message	2	28	2	3	2	3	5	1	1	5
Record message reception in the incoming circuit log	2	50	2	4	2	3	5	1	1	5
Record time of receipt on the received message	2	28	2	3	2	3	5	1	1	5

Task	Group	Criteria								
		1	2	3	4	5	6	7	8	9
Record message reception on the broadcast checkoff sheet	2	50	2	2	2	3	5	1	1	5
Perform sequence of operation on the R1051 radio receiver	2	33	2	3	3	3	5	2	3	5
Perform sequence of operation on the SSR-1 (VHF multi-channel)	3	--	4	3	2	2	2	1	2	4
Sequence outgoing original msg draft	2	--	4	4	2	2	5	1	1	5
Assign date/time group and SSN to outgoing message draft	2	45	1	5	2	2	5	1	1	5
Screen and review original outgoing message draft	2	38	2	4	4	4	5	3	4	5
Format outgoing msg for entry into TTY tape emission media--Autodin	1	--	1	4	4	4	5	3	4	5
Format outgoing msg for entry into TTY tape emission media--Modified 126	2	--	1	4	4	4	5	3	4	5
Format outgoing msg for entry into TTY tape emission media--ACP 126	2	--	1	4	4	4	4	5	3	4
Format outgoing msg for entry into voice transmission systems	1	--	2	4	4	4	5	3	3	4
Format outgoing msg for delivery by CW transmission media	1	--	4	4	4	4	5	3	3	5
Format outgoing msg for delivery by scanner (LDMX) system	2	--	1	4	5	4	5	3	3	5
Type smooth formated message draft	2	52	2	4	3	2	5	1	3	5
Screen & review smooth copy of outgoing messages for completeness & correctness	3	20	2	4	3	2	2	2	2	5
Deliver outgoing smooth msg to releasing officer for release	1	26	4	4	5	2	5	1	1	5

Task	Group	Criteria								
		1	2	3	4	5	6	7	8	9
Deliver outgoing message to selected circuit for transmission	2	--	4	4	5	2	5	1	1	5
Screen & review outgoing transmitted msg from circuit operator	3	20	2	4	3	2	2	2	2	5
Log outgoing message information into central msg log	2	54	1	2	2	2	5	1	1	5
Route outgoing msg into action, info departments	2	26	2	2	2	2	5	1	1	5
Reproduce copies of outgoing msg IAW route stamp	1	60	2	2	2	2	5	1	1	5
Stamp outgoing message with designated classification	2	56	4	4	2	1	5	1	1	5
Distribute reproduced copies of orig msg	1	40	1	3	2	2	5	1	1	5
Check outgoing msg prior to filing (traffic checker)	3	24	4	3	3	3	2	1	2	5
File outgoing messages into comm cen files	2	11	3	3	2	5	5	1	1	5
Advance route designated incoming msgs	2	--	4	5	2	2	5	1	1	5
Screen & review incoming messages	2	44	4	5	3	2	5	1	3	5
Log incoming msgs into central message log	3	54	1	3	2	3	5	1	1	5
Reproduce incoming messages	1	60	1	3	2	2	5	1	1	5
Distribute incoming messages	1	40	1	3	2	2	5	1	1	5
Check incoming messages prior to filing (traffic checker)	2	24	3	3	2	5	5	1	1	5
File incoming msgs into com cen files	3	11	4	3	3	3	2	1	2	5

Task	Group	Criteria								
		1	2	3	4	5	6	7	8	9
Accept message typed on Form DD-173 for input to LDMX/ NAVCOMPARS	3	--	1	5	5	1	5	1	1	5
Reject message on Form DD-173 (OCR operator)	3	--	1	3	3	1	5	1	2	5
File service messages (service area coordinator)	3	11	1	1	1	1	5	1	1	5

KEY

Groups

1. Tasks at the E-2 skill level which were not taught.
2. Tasks at the E-2 skill level which were taught.
3. Tasks above the E-2 skill level which were taught.

Criteria

1. Percentage of E-2s to E-4s Performing Task.
2. Probable Consequence of Inadequate Performance.
3. Delay Tolerance.
4. Learning Difficulty.
5. Probability of Deficient Performance.
6. Time Between Job Entry and Task Performance.
7. Decay Rate.
8. Complexity.
9. Frequency of Performance.

BIBLIOGRAPHY

Arkin, H., & Colton, R. R. Statistical Methods (4th ed., rev.). New York: Barnes & Noble, 1960.

Bock, R.D., & Jones, L.V. The Measurement and Prediction of Judgment and Choice. San Francisco: Holden-Day, 1968.

Chief of Naval Education and Training. Instructional Systems Development (NAVEDTRA 110). Pensacola: 1978.

Chief of Naval Education and Training. Letter Code N-54 to Chief of Naval Operations (OP-02, OP-3, OP-094), Subject: Radioman (RM) Job Task Inventory (JTI). 8 December 1976.

Commander, Naval Air Force, Pacific. UNCLASSIFIED Message to Commander-in-Chief, Pacific Fleet, Subject: Computer Managed Instruction RM "A" Schools. 212129Z November 1979.

Commanding Officer, Naval Education and Training Support, Pacific. Letter RPK: jat 1550 Ser N13/82 to Chief of Naval Education and Training, Subject: Prioritized Job Task Inventory for Radioman (RM) Rating. 11 May 1979.

Kennedy, R.P., Kalivoda, D.M., Dickie, I.G., Drummer, S.D., & Duemler, D.J. RM A Project Completion Report. San Diego: Naval Education and Training Support Center, Pacific, Instructional Programs Development Department, 1978.

Kim, J.O. Factor Analysis. In N. H. Nie, et al., SPSS Statistical Package for the Social Sciences (2nd ed.). San Francisco: McGraw-Hill, 1975.

Klecka, W.R. Discriminant Analysis. In N. H. Nie, et al., SPSS Statistical Package for the Social Sciences (2nd ed.). San Francisco: McGraw-Hill, 1975.

Lund, R. Personal communication, 22 February 1980.

McCormick, E.J., & Tiffin, J. Industrial Psychology (6th ed.). Englewood Cliffs, N.J.: Prentice-Hall, 1974.

Nie, N.H., Hull, C.H., Jenkins, J.G., Steinbrenner, K., & Brent, D.H. SPSS Stastical Package for the Social Sciences (2nd ed.). San Francisco: McGraw-Hill, 1975.

Radioman 3 & 2 (NAVEDTRA 10228-G). Washington, D.C.: U.S. Government Printing Office, 1978.

Rummel, R. J. Applied Factor Analysis. Evanston, IL: Northwestern University Press, 1970.

Tippett, L.H.C. The Methods of Statistics (4th ed.). New York: John Wiley & Sons, 1952.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, California 93940	2
3.	Deputy Chief of Naval Operations (Manpower, Personnel, & Training) (OP-01t, OP-10, OP-11, OP-12, OP-13, OP-136) Department of the Navy Washington, D.C. 20370	6
4.	Principal Deputy Assistant Secretary of the Navy (M&RA) OASN (MRA&L) Department of the Navy Washington, D.C. 20350	1
5.	Chief of Naval Education and Training (Code N51) N.A.S. Pensacola Pensacola, Florida 32508	1
6.	Department Chairman, Code 54 Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	1
7.	Professor James Arima, Code 54AA Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	5
8.	Professor Denise Rousseau, Code 54RS Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	1
9.	Commanding Officer Service School Command Naval Training Center San Diego, California 92133	1

10. CWO4 T. J. Chaudoin 1
Service School Command, Division 3120
Naval Training Center
San Diego, California 92133

11. Division N13 Project Manager 1
Naval Education and Training
Support Center, Pacific
San Diego, California 92132

12. Dr. Sheldon Zedeck 1
Department of Psychology
University of California
Berkeley, California 94720

13. Lieutenant Ronald G. Belanger, USN 1
210 MacArthur Road
Latham, New York 12110


DATE
ILMED
-8